NOVEMBER 2017

Missouri Forest Health 2017 Update

From the Missouri Department of Conservation

Forest Health Program

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Serving nature and you

Thousand Cankers Disease

Although not yet detected in Missouri, thousand cankers disease (TCD) remains a threat to eastern black walnut. TCD is believed to occur primarily when the walnut twig beetle (WTB), *Pityophthorus juglandis*, attacks walnut trees, spreading the fungus *Geosmithia morbida*. This causes small cankers to form in the phloem tissue under tree bark, eventually causing dieback and mortality.

There is concern that undetected TCD infestations could be present in Missouri or that spread may occur when infested walnut wood is moved from other states, especially those where TCD has been detected. TCD has been detected in most western states, as well as Maryland, North Carolina, Ohio, Pennsylvania, Tennessee and Virginia. In Indiana and Michigan, there have been walnut twig beetles detected in traps, but no TCD-positive trees have been found. In Illinois, Minnesota, and within specific locations in Indiana and North Carolina, *G. morbida* has been detected on other species of insects, but no walnut twig beetles or TCD-positive trees have been found. The Missouri Department of Agriculture has enacted a quarantine prohibiting certain walnut wood products and all hardwood firewood from coming into Missouri from states where TCD has been detected.

In Missouri, TCD is unlikely to be detected until several years after introduction, making reports of walnut tree dieback and decline very important. Missourians are encouraged to report suspect trees. For more information on what to look for and how to report declining walnut trees, visit the Missouri Invasive Forest Pest Council website **treepests.missouri.edu**. An online reporting form can be found linked to the TCD page on the website. Photos of suspect trees can also be emailed to **forest.health@mdc.mo.gov** as a first step in determining what trees should be visited by trained personnel.

TCD survey information on page 2

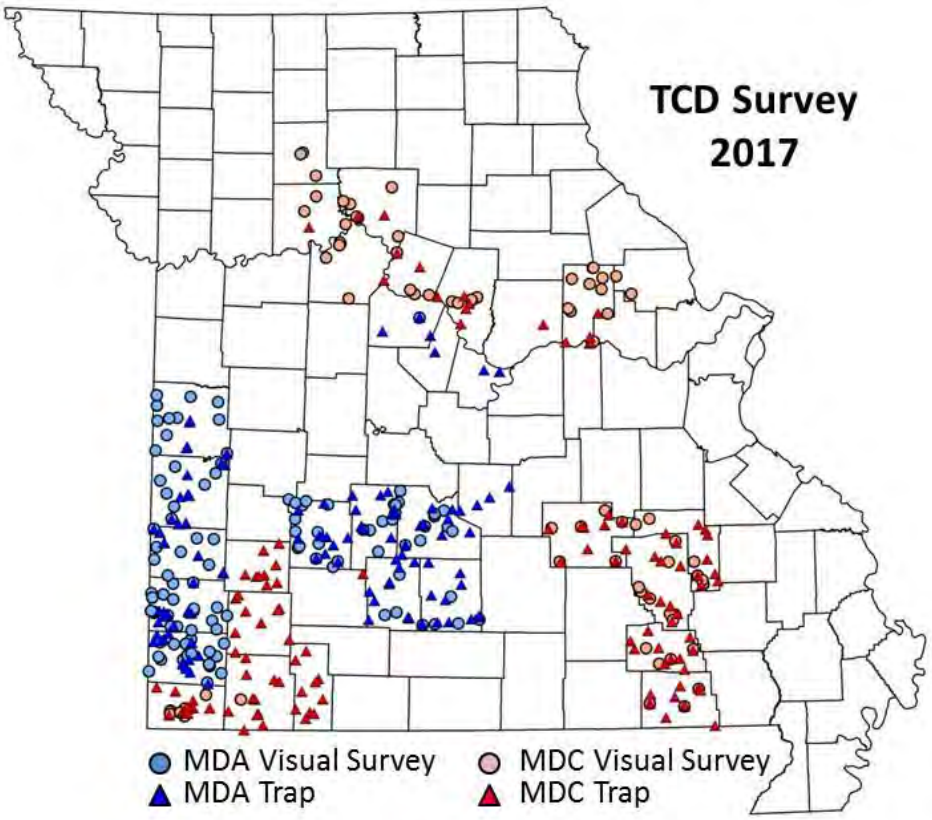
Symptoms of TCD include dieback in the upper crown. *Photo: Elizabeth Bush, Virginia Polytechnic Institute and State University, Bugwood.org*

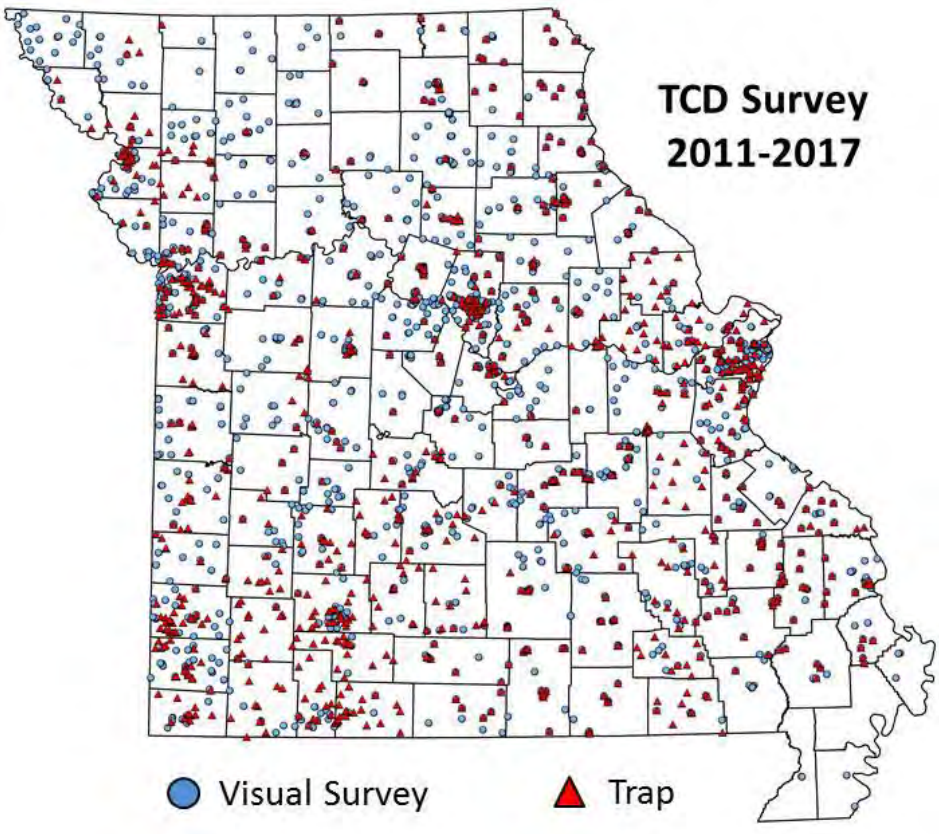
Thousand Cankers Disease Survey

In 2017, both the Missouri Department of Conservation (MDC) and the Missouri Department of Agriculture (MDA) conducted surveys for TCD using USDA Forest Service and USDA Farm Bill funding, respectively. Survey activities this year included 234 walnut twig beetle traps in walnut trees or at sawmill log piles and 404 visual surveys to identify potentially infested trees. Visual surveys were conducted in high-risk locations within 35 counties in central, southeast, and southwest Missouri. Branch samples were collected from highly suspect trees for lab evaluation from 15 locations with no evidence of TCD found. Analysis of trap catches is ongoing; however, no evidence of walnut twig beetle or *G. morbida* has been detected in 2017 samples.

Survey efforts are rotated to different regions each year. Since 2010, there have been 2,213 locations visually surveyed and 1,048 WTB traps deployed. Observations of walnut dieback were limited in 2017. When dieback was observed, affected trees were often infested by several wood-boring insects that commonly attack stressed walnut trees, including roundheaded and flatheaded borer larvae and ambrosia beetles.

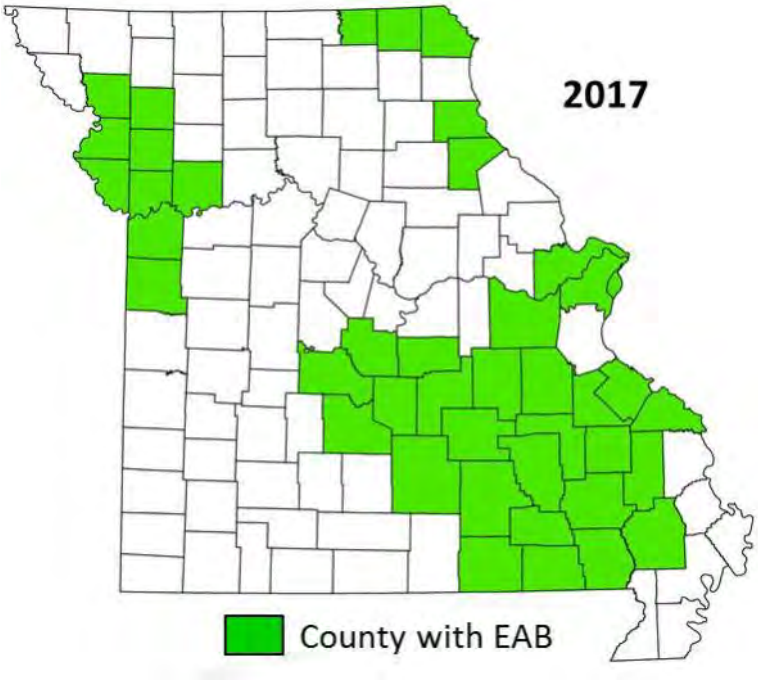
Walnut twig beetle trap. *Photo: MDC*





Emerald Ash Borers Detected in More Counties

The emerald ash borer (EAB), *Agrilus planipennis*, is an invasive beetle that has killed millions of ash trees in North America. It was initially discovered in the Detroit, Michigan area in 2002, but EAB likely entered that region a decade earlier via wood pallets and crating from China. EAB has now been detected in 31 US states and two Canadian provinces, stretching its range from Ontario to Texas and Colorado to South Carolina.



Missouri's first detection of EAB came in 2008 in Wayne County, near Lake Wappapello. Now 41 counties and the city of St. Louis are known to have EAB infestations. Ten of those county detections occurred during 2017. New detections in the south central part of the state include Camden, Maries, and Miller counties. In the northeast, Clark, Ralls, Schuyler, and Scotland counties were found to be positive. Closer to St. Louis, EAB was also detected in Crawford and Washington counties. On the western side of Missouri, EAB was found for the first time in Andrew County this year.

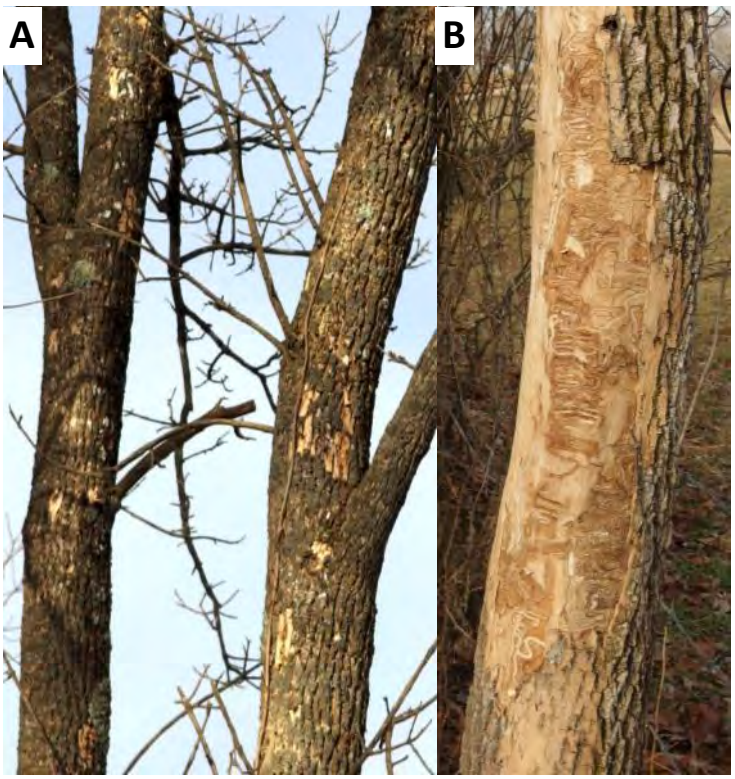
Many of the new EAB detections in 2017 were due to reports of bark blonding on ash trees, which is caused by woodpeckers searching for insect larvae inside the tree, popping off outer bark and revealing light-colored inner bark as they go. Look for ash trees with branch dieback and bark blonding in late winter or early spring. Ash trees with bark blonding may not have EAB, but it is certainly worth taking a closer look at those trees for this invasive pest. **Please report EAB suspects if they are in a new county where EAB has not yet been found.**

The Missouri Department of Agriculture, USDA APHIS PPQ, and University of Missouri monitored 225 purple prism traps in 33 counties throughout the state in 2017. Trap locations included high-risk areas like campgrounds and municipal yard waste facilities. EAB was captured on traps in three new counties this year—Andrew, Crawford, and Ralls.

EAB populations can expand slowly on their own to new areas, but the primary way that EAB spreads over long distances is by hitchhiking on firewood. To slow the spread of EAB and other invasive forest pests, don't move firewood. Buy it as close as possible to the location you plan to burn it, or harvest firewood on site, if permitted.

Options are available to protect healthy, high-value ash trees from EAB. Please see details in the "**Emerald Ash Borer Management Guide for Missouri Homeowners.**"

For more information or to report possible EAB, visit **eab.missouri.edu.**



Light bark blonding observed in the crown (A) of this ash tree lead to the discovery of multiple EAB larvae and galleries on the lower trunk (B). *Photos: MDC* ⇨

Rapid White Oak Mortality

White oak is an important species in Missouri due to its longevity, mast production for wildlife, and 2 billion dollar saw timber value. Significant white oak mortality was reported in central, east central, and southeast Missouri beginning in 2011. Unlike other common and well-studied patterns of oak decline and mortality in Missouri, this mortality disproportionately affects white oak. Affected tree crowns die rapidly and mortality is greatest on better quality sites for tree growth. This phenomenon has been described as rapid white oak mortality (RWOM) to separate it from other oak decline patterns. RWOM reports have been received from 45 Missouri counties on federal, state, and private lands. Mortality appears to have peaked in 2012, with few reports of new mortality in 2016 or 2017.

Research at the University of Missouri led by Dr. Sharon Reed, with funding from USDA Forest Service Forest Health Protection Evaluation Monitoring, Missouri Department of Conservation (MDC), and L-A-D Foundation, is ongoing. The team established 54 research sites on MDC and Mark Twain National Forest lands in east central and southeast Missouri. The team is collecting data on site and stand characteristics, measuring tree age and growth rates, and identifying associated insects and diseases.

RWOM pocket at Pea Ridge Conservation Area in east central MO. *Photo: MDC*

So far, the team's research suggests that tree mortality is affected by soil characteristics and the location of trees on a slope. At the bottom of the slope, the percentage of clay in the soil, slope steepness, and water availability were the main factors influencing the amount of mortality. Thin soils on the lower half of the slopes that experienced the most mortality tend to fluctuate between abundant soil moisture and dry soil conditions, have a higher soil pH (near neutral), and a lower percent clay. Preliminary investigations also suggest that stocking levels, a measure of the number of trees and their size, may not be related to the amount of damage observed.

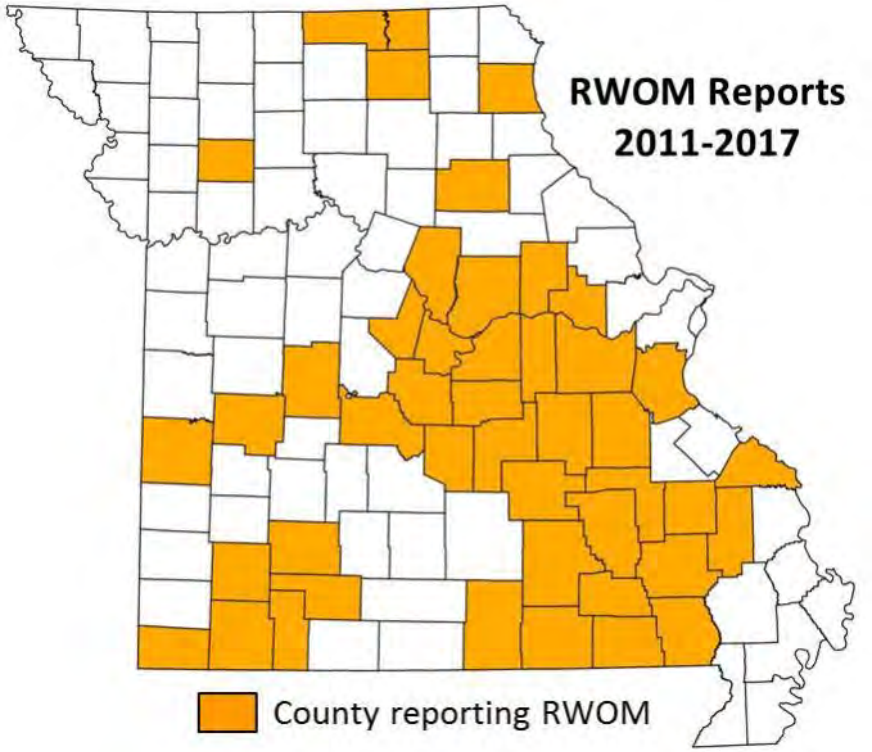
Large, dominant overstory white oak trees are affected most often, but many smaller trees also die of RWOM. Affected white oak may not be very old. A portion of the dead trees at two sites were between 65 and 90 years old, similar in age to the healthy trees in the stand. More age-related studies are underway. Healthy and declining white oak trees remain in most affected stands, especially on mid- and upper slopes. Observations of select trees at three RWOM-affected sites in Franklin and Washington counties suggest tree crown vigor has changed little in the past three years for a majority of trees. Some trees with moderate to severe levels of decline have developed additional symptoms, while some trees with low levels of decline symptoms have improved in appearance.

Phytophthora cinnamomi, an exotic root rotting pathogen associated with similar white oak mortality patterns in eastern states, was identified in 47% of the valleys studied between 2014 and 2016. The pathogen was found in Crawford, Shannon, Washington, and Wayne counties and is likely widely distributed. Recently, *P. cinnamomi* was also isolated from the main stem of a white oak in Sainte Genevieve County. Other commonly detected insects and diseases that primarily affect stressed trees included *Hypoxylon* canker, *Armillaria* root rot, and several wood-boring insect species.

Our understanding of RWOM as the result of multiple tree stressors working together to kill trees is improving but still limited. Because little new mortality has been observed the past few years, preemptive harvesting is not recommended in healthy stands. In RWOM stands with dying trees, affected trees decay rapidly and should be

harvested as soon as possible to avoid loss from decay or to prevent trees from becoming a hazard. RWOM may not be present in stands with only a few declining or dead white oak. These stands should be watched carefully prior to planning a harvest in response to RWOM.

Oak regeneration has been observed in RWOM locations, but competition with shade tolerant species is common. Management of undesirable species may be necessary to maintain an oak component on affected sites. Managers should also consider increasing stand diversity, especially on lower slopes and in drainages. Good stand management practices are recommended, although they may not prevent RWOM. With completion of the project in 2018, additional information may help us better predict and manage locations with RWOM.



RWOM pocket at Huzzah Conservation Area, Crawford County, MO. **Photo: MDC**

Oak Issues Continue in 2017

Oak Wilt

Oak wilt was active across the state in 2017. We confirmed several cases of the disease by testing branch samples. While most of our samples are received from urban areas, oak wilt could be present anywhere in the state. This year, we confirmed oak wilt for the first time in Gentry and Perry counties and for the first time affecting sawtooth oak (*Quercus acutissima*). More information on oak wilt can be found in **MDC's Oak Wilt Forest Health Alert**.

Oak wilt symptoms on sawtooth oak. *Photo: MDC*

Bacterial Leaf Scorch

Bacterial leaf scorch has been confirmed from urban areas in several parts of the state. While most of our positive detections have been from pin oak, bacterial leaf scorch affects many other species as well. Unlike oak wilt, bacterial leaf scorch tends to become apparent later in the growing season and leaves do not drop as quickly. It also tends to kill trees more slowly with a decline in tree health happening over several years. Find more information on bacterial leaf scorch through the **University of Kentucky's Extension Service**.

Pin oak infected with bacterial leaf scorch. *Photo: MDC*

Tubakia Leaf Spot

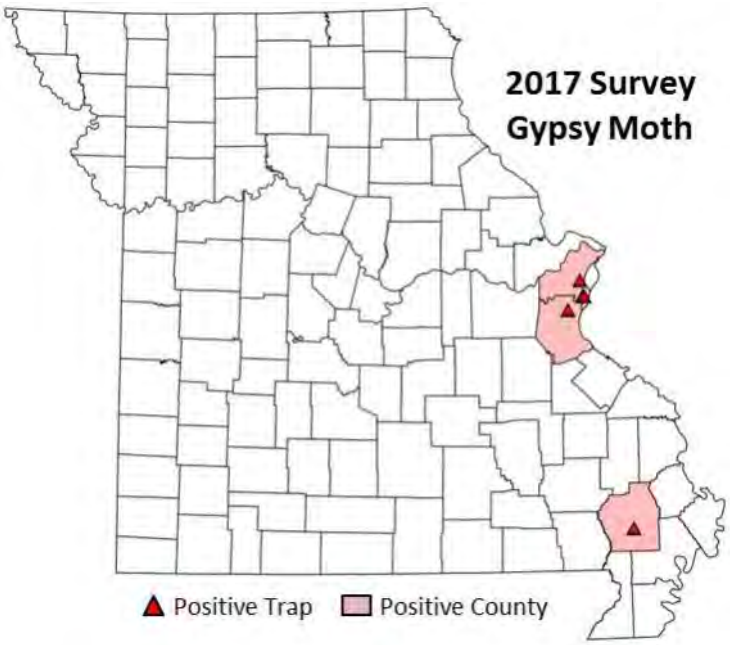
Late in the 2017 growing season, we received several reports of northern red, pin, and post oak leaf spots or defoliation, especially from managed landscapes in central Missouri. In some cases, leaf spots had coalesced on the leaves, leading to a scorched appearance. Severity was greatest on lower branches and the tree interior, and several trees were diagnosed with Tubakia leaf spot. This disease can be distinguished from oak wilt by timing and damage pattern (oak wilt typically occurs earlier and affects the upper canopy first). The visible lesions on the leaves also help separate this issue from bacterial leaf scorch. The disease can be confirmed by looking for the microscopic fungal fruiting structures in lesions found on the underside of the leaf. Find more information on Tubakia leaf spot through the **University of Wisconsin Extension**.

Northern red oak with Tubakia infecting the lower canopy. *Photo: MDC*

⇦ ***Coalescing lesions on a leaf infected with Tubakia.*** *Photo: MDC*

Gypsy Moth Survey: 5 Moths Captured in 2017

The multi-agency Missouri Cooperative Gypsy Moth Program conducted its annual survey to detect the presence of gypsy moth (*Lymantria dispar*) by placing and monitoring 6,396 traps in 59 counties. Five male European gypsy moths were captured statewide in 2017. Single male moths were captured in both Jefferson and Stoddard counties. Three male moths were captured in St. Louis County, each in separate traps, but two of those traps were located very near where a gypsy moth was captured in 2016. Fortunately, such low capture numbers likely mean that this invasive species is not established in St. Louis. We will intensively survey the area next summer to confirm no breeding populations of gypsy moth are present.



Missouri is not known to have any reproducing populations of gypsy moths. It is very easy, however, to transport gypsy moth egg masses to our state accidentally. Travelers returning from gypsy moth-infested states in July and August should examine vehicles and outdoor gear for tan, fuzzy egg masses. Please remove these masses before returning to Missouri.

High Japanese Beetle Numbers

This summer, people all over Missouri reported high numbers of Japanese beetles on a wide range of plants. Favorites included linden (basswood), elm, crabapple, sycamore, sassafras, plum, cherry, and bald cypress, as well as grape, Virginia creeper, and rose.

Japanese beetles are capable of entirely defoliating mature trees, leaving behind lacy-looking, skeletonized leaves. Healthy, established trees can typically tolerate a heavy amount of feeding damage. However, this damage stresses trees, and multiple years of defoliation could cause long-term tree health issues. You can help your trees by watering them 2-3 times per month during dry times to avoid additional stress from drought. A good rule of thumb is 10 gallons per inch of a tree's diameter.

Sycamore leaves skeletonized by Japanese beetles. *Photo: MDC*

If your trees suffered extensive Japanese beetle damage in 2017, consider ways to protect them next summer. Keep an eye out for the beetles starting in early to mid-June. Prevent early feeding damage by handpicking beetles off small or newly planted trees. If populations are too high to remove by hand, spray an insecticide labeled to control Japanese beetles on your particular tree species. Repeat, if needed, at labeled intervals. Systemic insecticides, such as those containing imidacloprid, can be applied as a soil drench to protect some types of trees from Japanese beetles (**not allowed** on linden/basswood trees; follow all label restrictions). However, a large tree can take up to 6 weeks to translocate this chemical from soil to the leaves, so choose an appropriate application date before Japanese beetles arrive. **Many insecticides, including systemic products, are not compatible with trying to maintain a pollinator-friendly yard and should never be used on flowering plants or trees that will attract bees and other pollinators.**

Drought conditions in July and August can lead to the death of many newly hatched Japanese beetle grubs. Some parts of Missouri did experience drought during those months in 2017, so Japanese beetle populations may be reduced locally in 2018. It is unlikely that our upcoming winter will be a limiting factor in grub survival; soil temperatures at or below 15°F are needed to kill this cold-adapted species.

Southern Pine Beetle in MO?

Adult southern pine beetle. *Photo: Erich G. Vallery, USDA Forest Service, Bugwood.org*

The southern pine beetle (SPB), *Dendroctonus frontalis,* is the leading insect killer of pine in the southeastern United States. This summer, the MDC Forest Health Program was asked to trap and submit SPB samples to the USDA Forest Service as part of a study using population genetics to characterize SPB range expansion. This project requires SPB samples from across the range of the species. Missouri is currently thought to be the northwestern-most extent of the SPB range, and obtaining individuals from our state is important in understanding genetic diversity in this species.

Five SPB traps baited with pheromone were placed in various Shannon County shortleaf pine stands. Traps remained in the field from mid-July through August and were checked periodically. Although SPB has been documented in Missouri, no SPB specimens were recovered from the traps. Trapping will be repeated next summer as part of the same study. In coming years as SPB continues expanding its range northwards, increased numbers of SPB and resulting pine death may become an important issue in Missouri.

Billboard Campaign: Don't Move Firewood!

In 2017, MDC used funding from the USDA APHIS Farm Bill to conduct a billboard campaign aimed at limiting firewood movement in Missouri. Ten billboards were placed around the state from April through June in locations likely to be seen by people heading to prime areas for outdoor recreation, including large lakes and the Ozark forests. This billboard campaign is part of a larger invasive forest pest outreach effort supported by the Missouri Invasive Forest Pest Council.

Billboard along I-44. *Photo: MDC*

Missouri is currently under a statewide quarantine that restricts the movement of hardwood firewood out of the state as well as the importation of hardwood firewood from some states (check with the **Missouri Dept. of Agriculture** for details). At this time, it is legal to move firewood within the state, but officials strongly recommend not moving firewood more than 50 miles from where it was harvested to reduce the risk of spreading invasive pests. **Moving firewood less than 10 miles from its origin is best.** For more information, visit **treepests.missouri.edu** and **DontMoveFirewood.org**.

Questions? Contact your local Resource Forester or Community Forester with the Missouri Department of Conservation.

Find contact information for your county at:
mdc.mo.gov

An electronic copy of this document can be found at **mdc.mo.gov** by searching "forest health news".

This project was funded in whole or in part through a grant awarded by the USDA, Forest Service, Northeastern Area State and Private Forestry. The USDA is an equal opportunity provider and employer.